11-9: Finite Differences

Begin by pairing up and working through the In-Class Activity on p. 723-4.

x	1	2	3	4	5	…
$y = 4x + 5$	9	13	17	21	25	…

1.a.

b.

c.

2. a.

b.

c.

3. a.

b.

4.

You should have determined that the degree of any polynomial can be found by checking the differences between dependent variables. You will continue to check the differences until they are all the same. You should have discovered that when:

1. 1^{st} differences are equal, you have a linear equation.
2. 2^{nd} differences are equal, you have a quadratic equation.
3. 3^{rd} differences are equal, you have a cubic equation.

Polynomial-Difference Theorem:

Example 1: Consider the data in the table. Is $f(n)$ a polynomial function?

n	1	2	3	4	5	6	7	8
$f(n)$	1	5	14	30	55	91	140	204

What you just did is the *Method of Finite Differences.*

Example 2: A sequence is defined by $\begin{cases} a_1 = 1 \\ a_n = (a_{n-1})^2 - 10a_{n-1} + 8, \text{ for } n \geq 2 \end{cases}$.
Is there an explicit polynomial formula for this? Justify your answer.

Homework:

"The only way of finding the limits of the possible is by going beyond them into the impossible."
- Arthur C. Clarke